# ALACV PROGRAM

# LACV Airburst Demonstration Fu
# 40mm Cannon Caliber Ammunit

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# Presentation Outline

- Program objectives
- Program background
- 40mm projectile
- S&A
- Fuze Electronics
- Ballistic test data
- Test Video
- Fragmentation Data
- Summary

# Program Objective

- Develop and Demonstrate improved Air Bursting Munitions and Advanced KE capability in 40mm.
- Goal: Achieve a 400% increase in lethal area for Air Bursting Munitions, and a 30% increase in Behind Armor Effects for Advanced KE

# Program Background

- Science and Technology Objective (STO) FY00-03
- Caliber:  Super 40
- Utilized IPT to combine in-house, contract, and CRADA efforts
- Projectile Body
  - Designed by ARDEC Warheads Team
  - Produced by GD-OTS
- Partnering with Alliant Techsystems to provide Demo Fuze for Air Bursting Warhead demonstration & development for 40mm round
- S&A – ARDEC Fuze Division (in-house effort)
- Electronics – ATK

# Demonstration Fuze Requirements

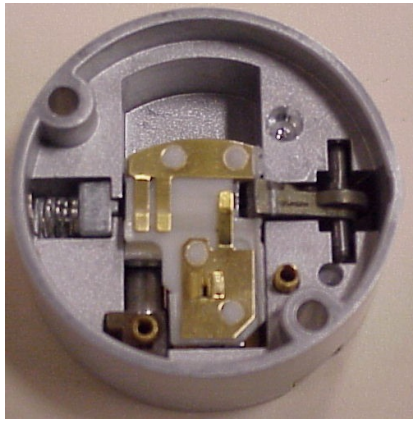
FY03 ballistic test with ARDEC projectile for warhead evaluation.

- Provide AB at 1500m from launch.
- Environments:
  - Setback: 80,000 Gs
  - Spin: 48,000 RPM
- Safety:
  - No Arm Distance: 60 meters
  - All Arm Distance: Dependent on command arm signal
- Base Fuze dimensions:
  - Height: 1.25”
  - Diameter: 1.22”

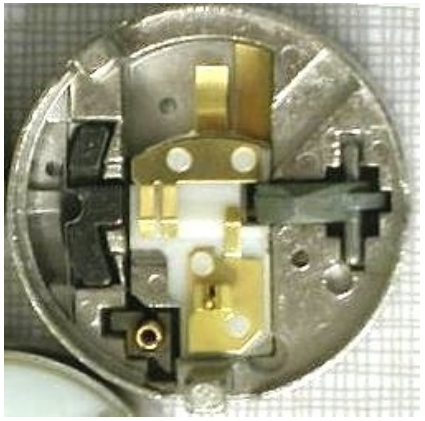
# ALACV S&A

- Utilized M762 artillery S&A with the following modifications
  - Reversed explosive train orientation
  - Replaced spin lock with small cal spin lock
  - Redesigned slider
    - Changed material from zinc die-cast to Al 7075-T6
    - Resulted in 40% weight reduction

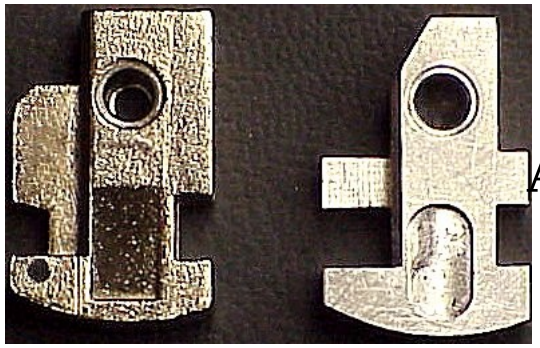
ALACV S&A



M762 S&A



M762 Slider



ALACV Slider

# ALACV S&A Testing

- Explosive Train Test
  - Ensure PA537 detonator initiates PBXN-5 lead and PAX-2A main charge
  - Air gap spacing worst case
  - All 5 units functioned
  - Testing was conducted at the Explosive Development Facility bldg. 3024, Picatinny Arsenal, NJ

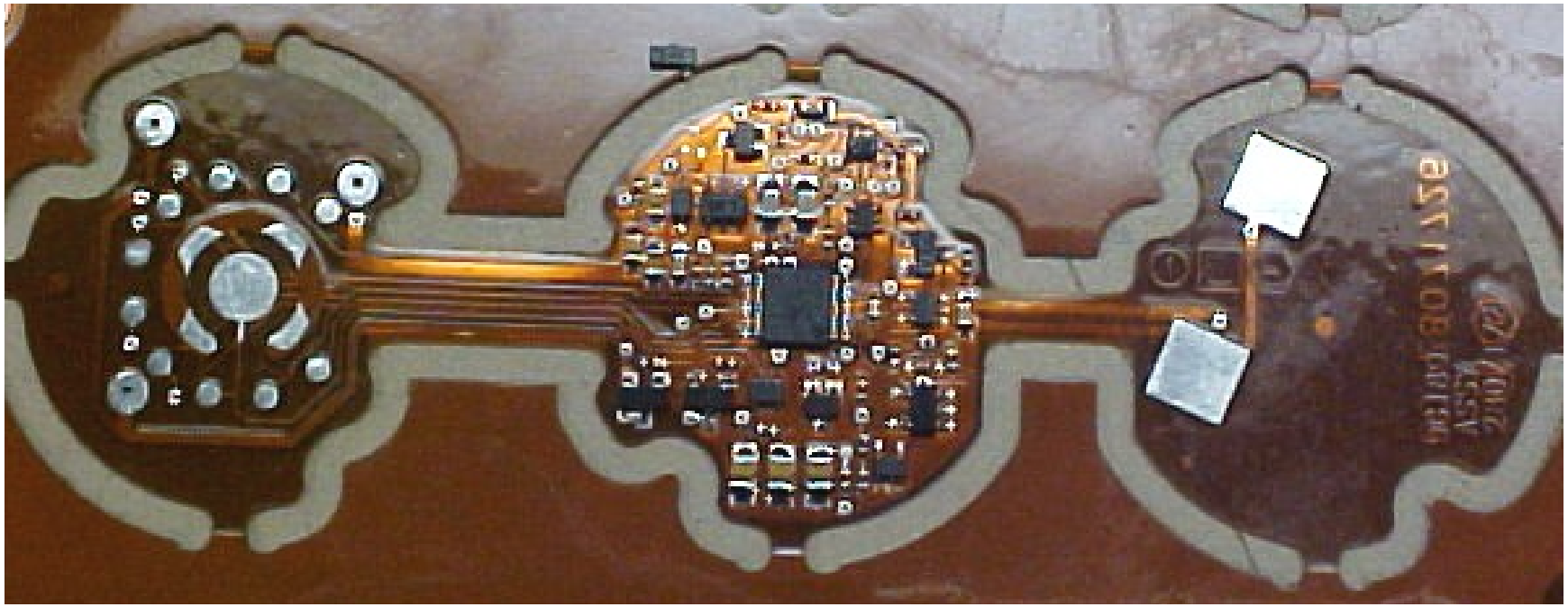
- Spin Test
  - 5 inert S&As subjected to 60,000 rpm spin environment
  - All units armed

- Out of Line Test
  - 8 S&As functioned out of line using PETN as acceptor
  - PETN did not function

# ALACV Fuze Electronics

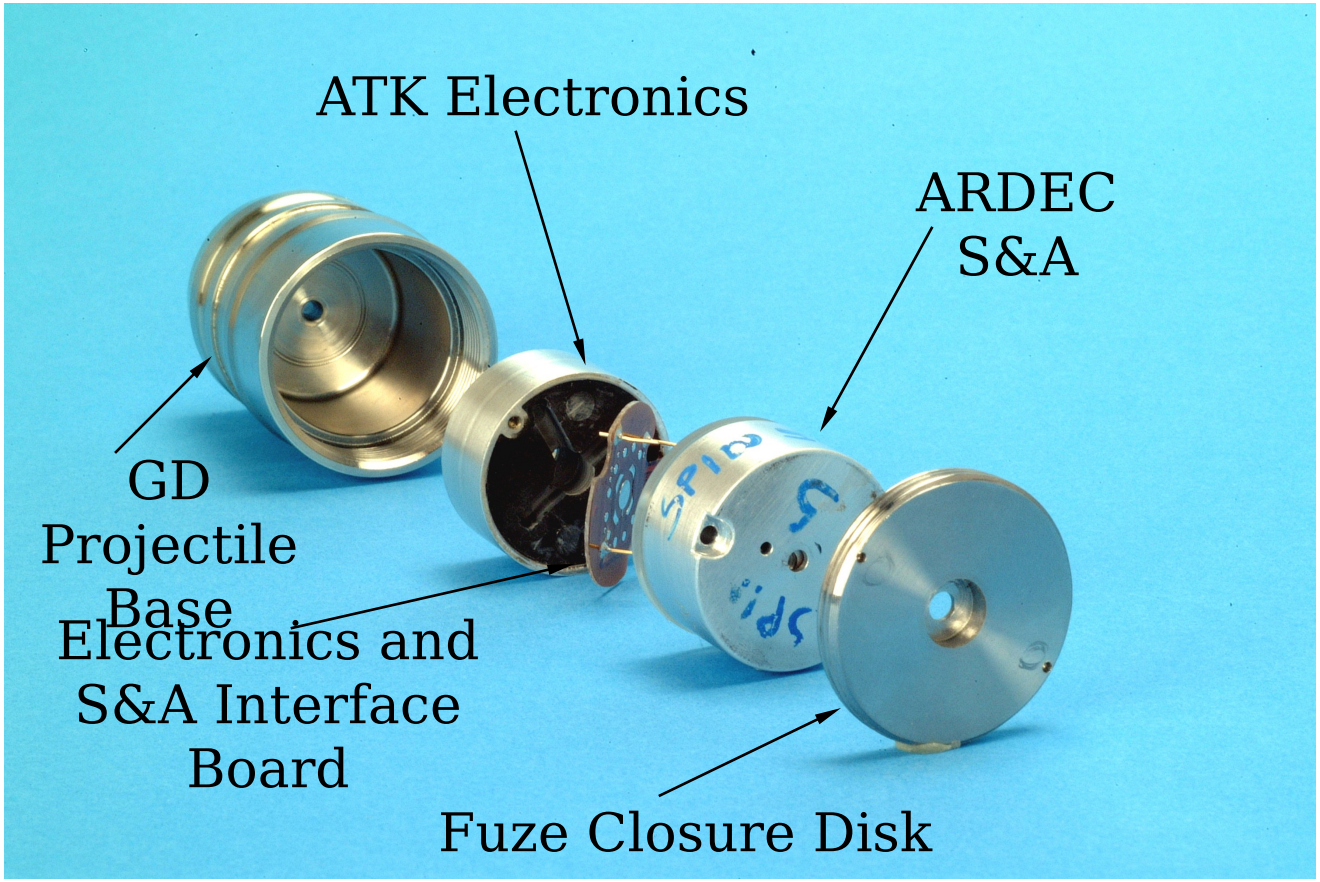
- Proven design repackaged for 40mm application
  - XM29 20mm, hundreds of successful tests
  - PAF 30mm, 36 successful air burst demonstration tests
  - XM29 20mm, MEMS S&A, initial testing very promising
- Turns Counting Circuitry
  - Reliable and accurate range estimation
- Fuze Modes
  - Only air burst mode implemented
  - Design compatible with additional modes such as PD and PDD
- Inductive set fuze
  - Reliable fuze setting

# Fuze Circuit Panel

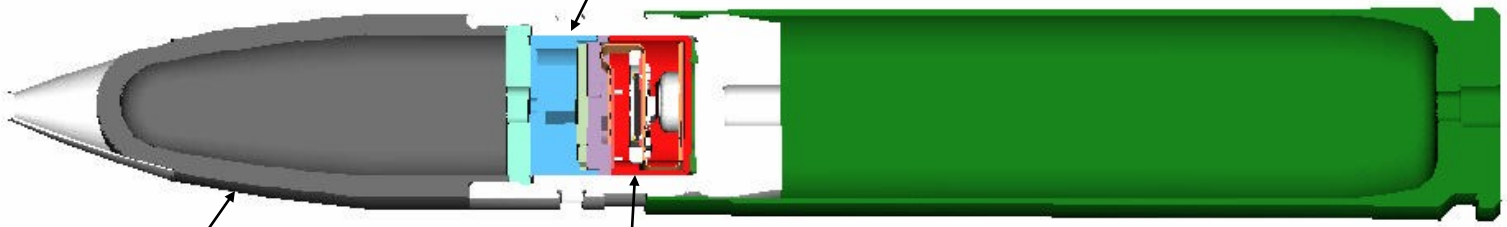


Designed To Meet Small Volume Requirements

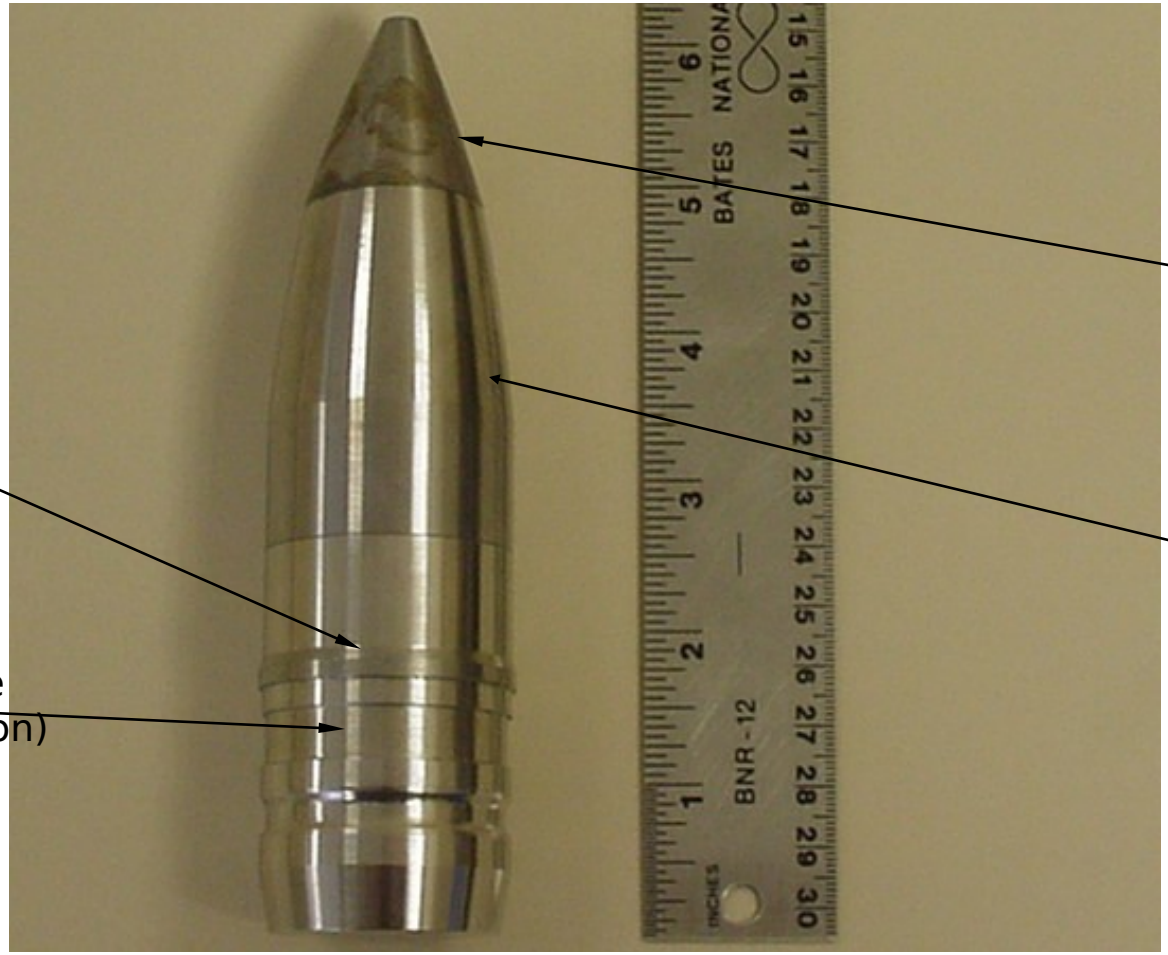
# ALACV Fuze Assembly



# ALACV Cartridge Assembly



# Tested ALACV Round Configuration


Windscreen (bonded w/ 3M adhesive)
Rotating Band (Sintered Iron)
Generation II Air Burst Warhead
Obturator Groove (Obturator is Nylon)

# Fuze Development Tests

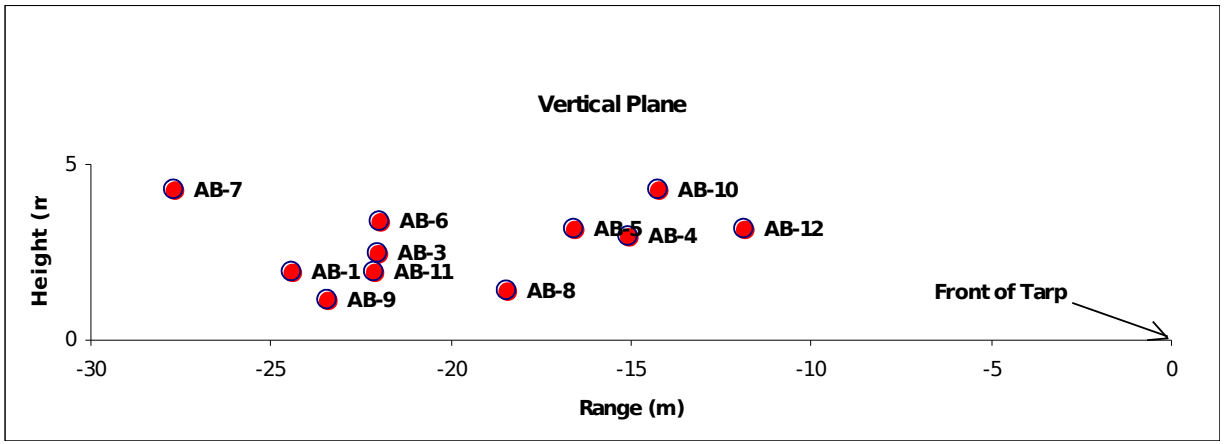
- Performed twelve 1500m soft-catch tests to assess fuze & projectile performance
  - Soft-catch series #1: S&A not arming, improved detonator and piston actuator contacts
  - Soft-catch series #2: Projectile compressing S&A on launch, turned down rotating bands
  - Soft-catch series #3: Good fuze function

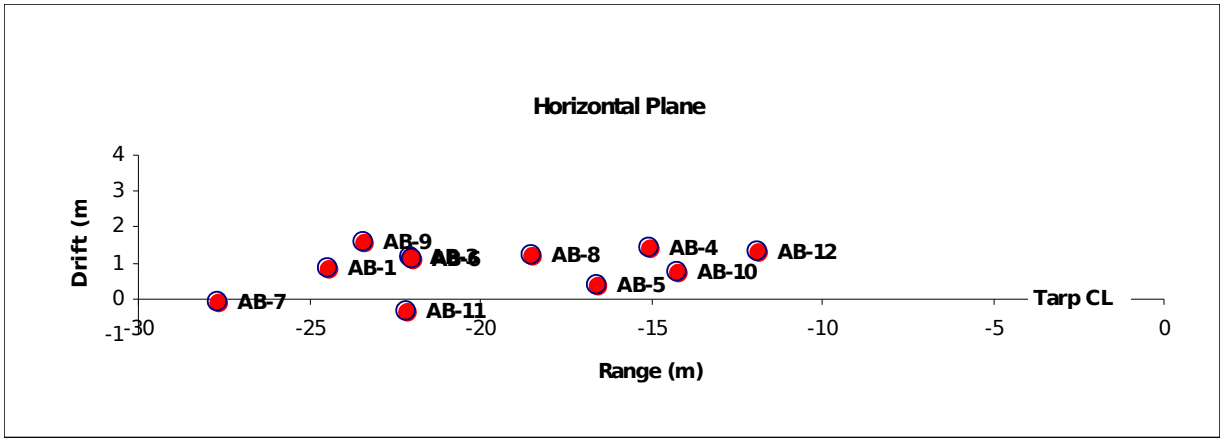
**Development Tests Paved The Path to Air Burst Demonstration**

# Successful Air Burst Demonstration

- December 2003, Alliant Techsystems Proving Ground in Elk River, Minnesota
  - 12 rounds fired
    - 6 rounds from Mann barrel
    - 6 rounds from MK44 auto gun including 3 round burst
  - Target
    - Dismounted infantry squad mannequins
    - ATGM site
    - All rounds functioned!

# Air Burst Locations



# ALACV Air Burst Data

**1500 Meter 40mm ALACV Air Burst**

| Date | Air Press. (mbars) | Air Temp (°C) | Barrel | Test ID | Radar Data Velocity m/s | Radar Data Burst Range m | Radar Data TOF sec |
|---|---|---|---|---|---|---|---|
| 10-Dec | 976.6 | -5 | Mann | **AB-1** | 935.7 | 1528.8 | 2.281 |
| 10-Dec | 976.9 | -5 | Mann | **AB-2** | 941.2 | 1502.5 | 2.208 |
| 10-Dec | 977.2 | -6 | Mann | **AB-3** | 940.2 | 1526.1 | 2.259 |
| 11-Dec | 982.3 | -18.9 | Mann | **AB-4** | 940.8 | 1520.3 | 2.279 |
| 11-Dec | 982.3 | -18.9 | Mann | **AB-5** | 943.2 | 1521.4 | 2.270 |
| 11-Dec | 982.3 | -18.9 | Mann | **AB-6** | 943.7 | 1527.1 | 2.271 |
| 11-Dec | 983.1 | -13.9 | Auto Gun | **AB-7** | 945.3 | 1531.6 | 2.297 |
| 11-Dec | 983.1 | -13.9 | Auto Gun | **AB-8** | 949.1 | 1521.6 | 2.263 |
| 11-Dec | 983.1 | -13.9 | Auto Gun | **AB-9** | 942.9 | 1526.9 | 2.289 |
| 11-Dec | 983.7 | -12.2 | Auto Gun | **AB-10** | 936.5 | 1518.1 | 2.286 |
| 11-Dec | 983.7 | -12.2 | Auto Gun | **AB-11** | 947.5 | 1530.4 | 2.285 |
| 11-Dec | 983.7 | -12.2 | Auto Gun | **AB-12** | 934.2 | 1515.4 | 2.295 |

| | | | | |
|---|---|---|---|---|
| **All Rounds** | **Average** | **941.69** | **1524.3** | **2.279** |
| | **Std Dev** | **4.59** | **5.3** | **0.013** |

**Range Error σ**

**Legend**

| | |
|---|---|
| | **AB-2 Data excluded from statistics due to loss of rotating band** |
| | **Auto Gun Three Round Burst** |

# ALACV 40mm Demonstration Video

# Summary

- Demonstrated airburst capability in a Super 40mm round

- Demonstrated increased lethality over current medium caliber ammunition

- Demonstrated accuracy of 5.3 meters at 1500 meter range